

SOBOL', A.F.; SEREDIN, Yu.V.

Portable block for the TISS radiometer used for the measurement
of soft β -radiations. Med.rad. 5 no.2:72-73 P '60.

(MIRA 13:12)

(RADIOMETER)

SOBOL', A.F.; PARMANIN, V.N.; SEREDIN, Yu.V.

Modified construction of the radiometer "Tiss" for solving some
problems in practical dosimetry. Med.rad. no.3:74-76 '62.
(MIRA 15:3)

1. Iz Instituta gigiyeny truda i profzabolevaniy AMN SSSR.
(RADIOMETER) (RADIATION--DOSAGE)

SOBOL', A.L.

Charles Darwin's evolutionary conception during the period preceding his acquaintance with Malthus's work (according to his unpublished "Notebook," 1837-1838) [with summary in English]. Zool. zhur. 37 (MIRA 11:6) no.5:643-658 My '58.

1. Institut istorii yestestvoznaniya i tekhniki Akademii nauk SSSR, Moskva.

(Darwin, Charles Robert, 1809-1882)

Sobol'
KAL'NITSKIY, Ya.B., kand. tekhn. nauk: SOBOL', A.V., gornyy inzh.; SOLOV'YEV,
A.A., dots.

Mechanization of loading in mining. Ger. zhur. no.2:39-43 F '58.
(MIRA 11:3)

1. Vsesoyuznyy nauchno-issledovatel'skiy institut Gormash (for
Kal'nitskiy, Sobol'). 2. Khar'kovskiy gornyy institut (for Solov'yev).
(Mining machinery)

AUTHOR: Sobol', A.V., Engineer

127-58-4-12/31

TITLE: Experimental and Designing Development of a Scraper and Loading Machine (Eksperimental'naya i konstruktivnaya razrabotka greb-kovoy pogruzochnoy mashiny)

PERIODICAL: Gornyy Zhurnal, 1958, Nr 4, pp 47-48 (USSR)

ABSTRACT: The author describes a new scraper and loading machine (the PMS-1) designed by the Institut VNIlgormash (The VNIlgormash Institute) in 1955-56 but as yet not put into production. The chief constructor of the project is Engineer V.M. Moroz. There is 1 figure.

ASSOCIATION: Gipronikel'

Card 1/1 1. Mines - Equipment - Design

SOBOL', A. V.

Cand Tech Sci - (diss) "Study of the use of automatic control elements in bucket loading machines using pneumatic drive." Leningrad, 1961. 19 pp; (Ministry of Higher and Secondary Specialist Education RSFSR, Leningrad Order of Lenin and Order of Labor Red Banner Mining Inst imeni G. V. Plekhanov); 150 copies; free; (KL, 5-61 sup, 193)

ODIONOV, Georgiy Viktorovich, doktor tekhn.nauk; KAL'NITSKIY, Yakov Borisovich, kand.tekhn.nauk; GURKOV, Konstantin Stepanovich, kand. tekhn.nauk; KOSTYLEV, Aleksandr Dmitriyevich, kand. tekhn.nauk; MIKHIREV, Petr Aleksandrovich, kand. tekhn. nauk; PRESS, Igor' Mikheylovich, nauchnyy sotr.; SOBOL', Arkadiy Vladimirovich, st. nauchnyy sotr.; SOROKO, Veniamin Vasil'yevich, kand. tekhn.nauk; BAZANOV, A.F., kand. tekhn. nauk, retsenzent; BULATOV, S.I., red. izd-va; SMIRNOVA, G.V., tekhn. red.

[Loading machines for loose and lump materials; design, teory, and calculation] Pogruzochnye mashiny dlia sypuchikh i kuskovykh materialov; konstruktsiia, teoriia i raschet. [By] K.S.Gurkov i dr. Moskva, Mashgiz, 1962. 286 p. (MIRA 15:12)

(Loading and unloading--Equipment and supplies)

KAL'NITSKIY, Ya.B., kand.tekhn.nauk; GONIK, M.Ye., kand.tekhn.nauk; SOBOL',
A.V., gornyy inzh.; GULEVITSKIY, Yu.D., gornyy inzh.

"Self-propelled equipment in mines" by M.P. Mochalin and V.A. Zve-
kov. Reviewed by IA.B. Kal'nitskii and others. Gor. zhur. no.7:79-80
Jl '62. (MIRA 15:7)

1. Gosudarstvennyy institut po proyektirovaniyu predpriyatiy nikelevoy
promyshlennosti, Leningrad.
(Mining machinery) (Mochalin M.P.) (Zvekov, V.A.)

SOBOL, A. Ye.

Antioxidants from biological sources for preventing rancidity in fats. E. S. Tatarenko, A. E. Sobol, and Z. N. Novikova (Ukr. Research Inst. Food Ind. Sci., Kharkov). *Mikrobiologiya* 24, 217-22 (1965).—The fungus *Naumoriella oleaginosa* can accumulate up to 52% lipoids (calcd. on dry wt.); its optimum conditions are, temp. 25-30°, pH 5-6, 0.2-1% KH_2PO_4 in the nutrient medium. *N. humicola* and a *Mortierella* species are nearly as active in storing lipoids, which contain 1-18% unsaponifiables of which one component at a concn. of 0.01% increases the rancidity resistance of edible fats 3.5-fold. Julian F. Smith

(2)

SHUL'GA, A.I., kand.med.nauk; SOBOL', B.B.

Over-all treatment of alcoholics. Vrach. delo no.2:127-128 P '61.
(MINA 14:3)

1. Khmel'nitskiy oblastnoy psikhonevrologicheskiy dispanser.
(ALCOHOLISM)

SOBOL', D.

First congress of Armenian scientific and technological societies.
Prom.Arm. 6 no.7:65-66 J1 '63. (MIRA 16:9)

SOBOL', D.

Every member of a scientific and technological society should be
an active participant in the inspection. Prom. Arm. 6 no. 10:67-68
0 '63. (MIRA 17:1)

SOBOL', D.I.

Increasing the capacity of crushed stone plants. Put' i put.khoz.
4 no.6:28-30 Je '60. (MIRA 13:7)

1. Glavnyy inzhener proyektov Kiyevskogo filiala "Girpotranskar'yer."
(Stone, Crushed)

BOYCHUK, I.N., inzh.; SOBOL', D.I., inzh.

Resources of stone crushing plants. Stroi. mat. 9 no.10:12-14
0 '63. (MIRA 16:11)

SOBOL', F.D.

Boring slots in the connecting rods of SKhTZ-NATI tractors. Mekh.
sil'. hosp. 8 no.9:18 S '57. (MLRA 10:9)

1. Zaviduyuchiy maysterneyu Rozhishchens'koy Mashinno-traktornoy
stantsiyey, Volins'koy oblasti.
(Tractors--Maintenance and repair)
(Connecting rods)

SOBOL', F.D.

Mobile winch. Mekh.sil'. hosv. 9 no.3:18 Mr '58. (MIRA 11:4)

1. Zaviduyuchiy maysterneyu Rozhishchens'koi mashinno-traktornoi
stantsii, Volins'koi oblasti.
(Winches)

SOBOL', F.D., inzh.-mekhanik

Making disks for tractor cardan shaft heads. Mekh.sil'hosp.
10 no.2:14-15 F '59. (MIRA 12:6)
(Tractors--Maintenance and repair)

SOV/58-59-5-11105

Translation from: Referativnyy Zhurnal Fizika, 1959, Nr 5, p 170 (USSR)

AUTHOR: Sobol', G.A.

TITLE: The Detector-Response Method for a Gas-Discharge Plasma^{2/}

PERIODICAL: Nauk. zap. Melitopol'sk. derzh. ped. in-t, 1957, Vol 4, pp 245 - 253
(Ukr.; Russ. résumé)

ABSTRACT: The author investigated experimentally the detector properties of the plasmas of arc, glow, and high-frequency discharges in Ar, Ne, Hg vapors, and their mixtures. He submits an empirical formula for the probe-potential dependence of the detector current on the probe, which allows the plasma parameters to be found to a sufficient degree of accuracy by means of the detector-response method.

L.L. Pasechnik

Card 1/1

SOV/58-59-5-11106

Translation from: Referativnyy Zhurnal Fizika, 1959, Nr 5, p 170 (USSR)

AUTHORS: Kononenko, K.I., Sobol', G.A.

TITLE: The Influence of Some Factors on the Detector Effect of Gas-Discharge Plasma

PERIODICAL: Nauk. zap. Melitopol'sk. derzh. ped. in-t, 1957, Vol 4, pp 255 - 272
(Ukr., Russ. résumé)

ABSTRACT: Using the detector-response method, the authors investigated experimentally the influence of various factors on the detector effect in the plasmas of glow, arc, and high-frequency discharges in Ne, Ar, Hg vapors and their mixtures. They studied the influence of the electrical mode of discharge, gas pressure, frequency of the signals being detected, and position and orientation of the probe. They established the existence of optimum values for the discharge current, potential at the discharge, and gas pressure, at which the detector effect is greatest. They point out the possibility of designing a plasma frequency-meter (at weak discharge currents), as well as a plasma voltmeter for measuring UHF voltages.

L.L. Pasechnik

Card 1/1

SOV/58-59-5-11107

Translation from: Referativnyy Zhurnal Fizika, 1959, Nr 5, p 170 (USSR)

AUTHORS: Sobol', G.A., Kononenko, K.I.

TITLE: On the Process of Detection and the Sensitivity of the Plasma Detector ^{2/}

PERIODICAL: Nauk. zap. Melitopol'sk. derzh. ped. in-t, 1957, Vol 4, pp 273 - 279
(Ukr.; Russ. résumé)

ABSTRACT: Using the detector-response method, the authors studied experimentally the phenomenon of detection in a gas-discharge plasma. They submit a formula for the detector sensitivity of the plasma, from which it is possible to determine the influence of various factors (the charge concentration in the plasma, the temperature of the electron gas, the ionization frequency, the kind of gas, etc.) on the phenomenon of detection. They point out the possibility of using the detector-response method to determine the intensity of ionization.

L.L. Pasechnik



Card 1/1

SOBOL', G. A.

Detector characteristics of a plasma. Izv. vys. ucheb. zav.;
radiofiz. 5 no.5:963-971 '62. (MIRA 15:10)

1. Chernovitskiy meditsinskiy institut.

(Plasma(Ionized gases))

L 55106-65 EWT(1)/EPF(n)-2/ENG(m)/EPA(w)-2 Pz-6/Po-4/Pab-10/Pi-4 IJP(c)
 WW/AT
 ACCESSION NR: AP5014519 UR/0141/65/008/002/0420/0421
 533.951.

AUTHOR: Sobol', G. A.

TITLE: Detection of centimeter waves in a gas discharge plasma

SOURCE: IVUZ. Radiofizika, v. 8, no. 2, 1965, 420-421

TOPIC TAGS: gas discharge plasma, glow discharge, centimeter wave detection, plasma detector

ABSTRACT: The probe characteristic $I_p=f_1(V_p)$ and the detector characteristic $I_d=f_2(V_p)$ of a glow discharge in a plasma were measured simultaneously at 50, 10⁶, and 10¹⁰ cps. These results are plotted in Fig. 1 of Enclosure. Comparison of the three detector characteristics under the same discharge conditions indicates that they are inherent in the plasma over a wide frequency range. Thus a plasma detector of unlimited power can be constructed for frequencies ranging from 20 to 10¹⁰ cps. Tuning to the desired frequency can be accomplished by varying the probe voltage V_p of the appropriate anode. It is asserted that the detector effect is determined chiefly

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ACCESSION NR: AP5014519

by processes occurring at the cathode when the latter is irradiated by a shf field. The following experimental facts serve to support this assertion: 1) The detector effect is observed only when the cathode region of the discharge is irradiated by the shf field and is completely absent when other discharge regions are irradiated. 2) The detector effect is not observed in air arc discharge. 3) During irradiation of the cathode lead, I_d maximum is observed when antinode E_0 of the shf field is present at the cathode. 4) The size of the detector effect depends on both the cathode material and the type of gas in the discharge tube, but is independent of the anode and probe materials. [JR]
Orig. art. has: 3 figures.

ASSOCIATION: Chernovitskiy meditsinskii institut (Chernovitsy Medical Institute)

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NO REF SOV: 000

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Card 2/3

L 55106-65

ACCESSION NR: AP5014519

ENCLOSURE: 01

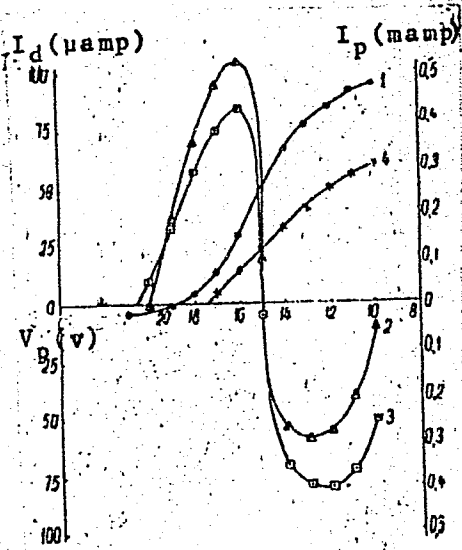


Fig. 1. Probe and detector characteristics (I_p and I_d , respectively) at frequencies of 50, 10^9 , and 10^{10} cps for neon (1 mm Hg)

Card 3/3

SOBOL', G.F.

Device for measuring the beat of antifriction bearings. Izv. tekhn.
no. 1:28-29 Ja '65. (MIRA 18:4)

SOBOL', G.M., strogal'shchik

Collective approach to machining, Mashinostroitel' no.7:12-13
Jl '64. (MIRA 17:8)

1. Irkutskiy zavod imeni V.V. Kuybysheva.

KOLOMEYCHUK, V.I., agronom po zashchite rasteniy (g. Zhmerinka,
Vinnitskoy oblasti); SOBOL', G.Ye.; BOYKO, P.P.

Is it necessary to fumigate slightly infected pea seeds?
Zashch. rast. ot vred. i bol. 7 no.7:14-15 JI '62. (MIRA 15:11)

1. Zaveduyushchiy entomologicheskoy laboratoriyey
Belotserkovskoy opytno-selektsionnoy stantsii (for Sobol').
2. Starshiy agronom Ternopol'skoy karantinnoy inspektsii
(for Boyko).

(Peas--Diseases and pests)
(Fumigation)

SOROL', G. Ye. Cand Biol Sci. -- (diss) "The ^{control of} Effectiveness of DDT and
hexachlorane in the ~~struggle~~ ^{against} beet curculionidae (Bothynoderes
punctiventris Germ.) as a function of conditions of their ^{application} utilization."
Belaya Tserkov', 1955. 18 pp (Min of Agr USSR. Belaya Tserkov' Agr Inst),
100 copies (KL, 13-58, 95)

-53-

USSR / General and Specialized Zoology - Insects.

P

Abs Jour : Ref Zhur - Biologiya, No 5, 1959, No. 20917

Author : Sobol', G. Ye.
Inst : Belaya Tserkov Experiment-Selection Station

Title : Tests of Emulsions of Chlortene [$C_{10}H_{10}Cl_8$],
Polychloropinene and Chlorindane [chlordan]

Orig Pub : Zashchita rast. ot vredit. i bolezney,
1958, No 2, 41-42

Abstract : According to experiments carried out by the Belaya Tserkov Experiment-Selection Station, a two-fold spraying of beet with emulsions of chlortene, polychloropinene and chlorindane, in 1955-57, is stronger in its action upon the sugar beet beetle

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USSR / General and Specialized Zoology - Insects.

P

Abs Jour : Ref Zhur - Biologiya, No 5, 1959, No. 20917

as compared to a treatment with DDT emulsion, and has protected plants from damage by the weevil, as well as decreased the number of larvae in one m^2 from 80-200 in the control to 6-8 in the experimental field. Even at a low temperature, spraying with chlortene and polychloropinene has caused the death of 86-87% of beetles with an outlay of concentrate of 1-1.5 kg/ha and of 94% with 2 kg/ha. The norm of the outlay for first sprayings is 1.5-2 kg/ha, which can be later reduced at a temperature of 18-20° to 1.2 kg/ha. The phytocidal effect of the emulsions of these preparations is not greater than that of emulsions of DDT and hexachlorocyclohexane.
-- A. P. Adrianov

Card 2/2

SEDYKH, A.S.; SOBOL', G.Ye.

Mercaptophos treatment of beet seeds before sowing as a means
for controlling the beet weevil. [Trudy] NIUIF no.171:27-29
'61. (MIRA 15:7)
(Beet pests) (Mercaptophos)

SOBOL', G.Ye.

Treating pea seeds before sowing. Zashch. rast. ot vred. i
bol. 9 no.2:27-28 '64. (MIRA 17:6)

1. Zaveduyushchiy entomologicheskoy laboratoriyey Opytno-
selektionnoy stantsii, Belaya TSerkov', Kiyevskoy oblasti.

SOBOL', Iona Moiseyevich

[First aid in diseases and injuries of the ear, nose, throat,
and esophagus] Skoraia pomoshch' pri zabolevaniakh i travmakh
ukha, nosa, gorla i pishchevoda. Izd.2. Stavropol', Stavro-
pol'skoe knizhnoe izd-vo, 1959. 144 p. (MIRA 13:8)
(OTOLARYNGOLOGY) (FIRST AID IN ILLNESS AND INJURY)

SOBOL, IONA M.

"Hormonal treatment as prevention of postoperative complications
and during extirpation of the larynx for cancer."

report submitted for the Seventh Intl. Congress of Otorhinolaryngology,
Paris, 23-29 July 1961

Stavropol, USSR

SOBOL', I.M., prof.

Allergy in the pathogenesis of polyposis of the nose and its
accessory sinuses. Vest.otorin. no.6:3-11 '61. (MIRA 15:1)

1. Iz kliniki bolezney ukha, nosa i gorla Stavropol'skogo medi-
tsinskogo instituta.
(NOSE, ACCESSORY SINUSES OF--DISEASES) (ALLERGY)

SOBOL, I. M.

Sobol', I. M. On the asymptotic behavior of the solutions of linear differential equations. Doklady Akad. Nauk SSSR (N.S.) 61, 219-222 (1948). (Russian)

Consider the equation $y^{(n)} = \sum_{i=1}^n a_i(t) y^{(n-i)}$, where

$$(1) \quad \int_a^\infty |a_i(t)| t^{-1} dt < \infty.$$

Set

$$(2) \quad \psi(x) = \sum_{i=1}^n \int_a^\infty |a_i(t)| t^{-1} dt.$$

The author proves that if (1) is satisfied, there exists a fundamental set of solutions $y_s(x)$, $0 \leq s \leq n-1$, having the form

$$(3) \quad y_s(x) = x^s + O\left(\int_a^x \dots \int_a^t \psi(t) dt\right).$$

He also considers the case where the differential equation above has a nonhomogeneous term $b(t)$. These results are extensions of results of Wilkins [Bull. Amer. Math. Soc. 50, 388-394 (1944); these Rev. 5, 265] and of Haupt.

R. Bellman (Stanford University, Calif.).

Source: Mathematical Reviews,

Vol 10, No. 1

SOBEL', I. M.

"The Asymptotic Approach to the Solution for Differential Equations," Dok. Ak. 61, No. 2, 1948; "Riccati Equations and Linear Equations of the Second Order Reducible to Them," ibid., 65, No. 3, 1949.

Sobol' ; I.M.

200

Sobol' I.M. Investigation with the aid of polar coordinates of the asymptotic behavior of solutions of a linear differential equation of the second order. Mat. Sbornik N.S. 28(70), 707-714 (1951). (Russian)

The equation $\ddot{x} + 2p(t)\dot{x} + q(t)x = 0$ is considered. In case constants p and q exist such that $q - p^2 = c^2 > 0$ and $\int_a^t |p(t) - p| dt = o(t)$ as $t \rightarrow \infty$ and similarly for $q(t)$ then it is shown easily that the successive zeros t_n of a real solution satisfy $t_n \sim \pi n / c$. If $p(t)$ and $q(t)$ are of bounded variation over (a, ∞) then $x(t) = O(\exp[-\int_a^t p(t) dt])$. [Here much more is known. From a result of the reviewer [Duke Math. J. 15, 111-126 (1948); these Rev. 9, 509] it follows that there exist independent solutions x_1 and x_2 with $x_1(t) \sim \exp(\int_a^t ([p^2(t) - q(t)]^{1/2} - p(t)) dt)$ and x_2 similarly with

a minus before the square root.] The case $\ddot{x} + \omega^2(t)x = 0$ is considered with various hypotheses in $\dot{\omega}/(2\omega^2)$. [The results when $\dot{\omega}/\omega^2$ is of bounded variation on (a, ∞) can be improved by using the result of the reviewer mentioned above.] Further results are given.

N. Levinson.

Source: Mathematical Reviews,

Vol 13 No. 5

Smirnov

SOBOL', I.M.

Boundary solution for the Riccati equation and its application to the study of solutions for a linear differential equation of the second order. Uch.zap.Mosk.un. no.155:195-205 '52. (MIRA 8:7)
(Differential equations, Linear)

SOBOL', I. M.

3
✓ Sobol', I. M. Positive solutions of linear differential equations with retardation. Moskov. Gos. Univ. Uč. Zap. 181. Mat. 8 (1956), 45-56. (Russian)

The author shows that the functional equation $u''(x) = m(x)u(x-d(x))$ in the case where $m(x) \geq 0$ and $d(x) \geq 0$, possesses solutions which act like 1 and x asymptotically if the integral $\int_{\infty}^{\infty} xm(x)dx$ is convergent, and solutions act like exponentials with positive and negative exponent if the integral diverges.

R. Bellman
SMW //

SOBOL', I.M.

An iteration method of calculating eigenvalues. Usp.mat.nauk 12
no.3:377-380 My-Je '57. (MIRA 10:10)
(Eigenvalues)

20-114-4-8/63

AUTHOR: Sobol', I. M.

TITLE: Multi-Dimensional Integrals and the Monte Carlo Method
(Mnogomernyye integraly i metod Monte-Karlo)

PERIODICAL: Doklady Akademii Nauk SSSR, 1957, Vol. 114, Nr 4,
pp. 706-709 (USSR)

ABSTRACT: The present paper investigates the errors of the simplest formula of integration

$$I = (1/N) \sum_{\mu=1}^N f(P_{\mu}) + \Delta_N.$$

The calculation of the integrals by means of the Monte Carlo method can be reduced to the same formula with random integration nodes. The integration formula: The function $f(P)$, where $P = (x_1, \dots, x_d)$ is holomorphic with a sphere which contains the unit cube K of the d -dimensional real space: $0 < x_s < 1$ ($s = 1, 2, \dots, d$). The integral $I = \int_K f(P) dV$ is calculated according to the simplest formula of arithmetic average values: $I = (1/N) \sum_{\mu=1}^N f(P_{\mu}) + \Delta_N.$

Card 1/3

Here P_1, P_2, \dots, P_N denote the nodes of integration and

Multi-Dimensional Integrals and the Monte Carlo Method

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Δ_N the error, $\{P_\mu\}$ denotes any sequence of points in K. Then follows the definition of the uniformly distributed sequence of points in K.

Theorem: For all functions integrable according to Riemann $\lim_{N \rightarrow \infty} \Delta_N$ applies, but only then, if $\{P_\mu\}$ in K is uniformly

distributed. By this theorem the problem of convergence of the initially-given formula is also solved. The Monte Carlo method also leads to the aforementioned formula, but then random nodes exist.

Uniform Networks and the Monte Carlo Method: It is assumed that this network consists of $N = nd$ points with the coordinates $x_{\mu s} = (m_{\mu s} + 1)/n$ ($s = 1, 2, \dots, d$), where $m_{\mu s}$ denote the natural figures $0, 1, 2, \dots, n - 1$; $0 < 1 \leq 1$.

Theorem: With $l_s = 1/2$, $\Delta_N = A_1 N^{-1/d} + O(N^{-2/d})$ applies. But with $l_1 = l_2 = \dots = 1/2$, $\Delta_N = A_2 N^{-2/d} + O(N^{-4/d})$ applies.

The following estimation of probabilities the Monte Carlo method is then given: With a probability exceeding 0,99,

$|\Delta_N| \leq 3 \sqrt{d} N^{-1/2}$ applies. The further passages give a

definition of the function $\varphi_q(N)$, an evaluation of Δ_N for any

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Multi-Dimensional Integrals and the Monte Carlo Method

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integration nodes, some properties of $\varphi_q(N)$ as well as some consequences and examples.

There are 5 references, 1 of which is Soviet.

ASSOCIATION: Otdeleniye prikladnoy matematiki Matematicheskogo instituta im. V. A. Steklova Akademii nauk SSSR (Department of Applied Mathematics of the Mathematical Institute imeni V. A. Steklov of the Academy of Sciences of the USSR)

PRESENTED: December 25, 1956, by M. V. Keldysh, Member, Academy of Sciences, USSR

SUBMITTED: December 18, 1956

Card 3/3

VLADIMIROV, V.S.; SOBOL', I.M.

Calculating the least characteristic number of Paierls' equation
by the Monte Carlo method. Vych.mat. no.3:130-137 '58.
(MIRA 12:1)

(Integral equations)

30V/52-3-2-1/10

AUTHOR: Sobol', I. M.

TITLE: Pseudo-Random Numbers for the Machine "Strela"
(Psevdosluchaynyye chisla dlya mashiny "Strela")

PERIODICAL: Teoriya veroyatnostey i yeye primeneniya, 1958, Vol III,
Nr 2, pp 205-211 (USSR)

ABSTRACT: The random numbers required for the Monte Carlo method of calculation are usually obtained from the tables. This is not practicable if high speed automatic machines are employed, when an application of pseudo-random numbers is advisable. There are two methods of obtaining the pseudo-random numbers: the method of mean squares and the deduction method. The test of random numbers is best carried out by means of the Kendall-Smith method involving a five point test for frequency (T_1), series (T_2), gap (T_3) and poker (T_4). The gap test can be replaced by run test (T_5). The solution of a problem worked out by the Monte Carlo method can be summarised as an evaluation of the mathematical expectation of a defined integral. Thus it is possible to avoid the application of probability and the question can be treated as determinate. The formula (Eq.1) can be applied and the sequence of points (p_i) can be grouped into

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SOV/52-3-2-9/10

Pseudo-Random Numbers for the Machine "Strela"

d numbers which are treated as the co-ordinates of a d-dimensional cube. In this form they can be employed by an electronic computing machine such as "Strela". The "Strela" machine belongs to a type of computer with floating decimal points. Its speed is 3000 operations per second. The reading counter has 43 d i g i t s showing the mantissa (p) and the index (q) according to the formula:

$$x = \pm p.2^{\pm q}$$

A number γ_k is being determined in three operations: at first it is multiplied by 10^{17} , then the result is carried out eight divisions to the left and finally the absolute value γ_{k+1} is obtained. The figure 10^{17} is a constant introduced in order to have $0.5 \leq \gamma_{k-1} \cdot 10^{17} < 1$. The number of digits and the sequence of the pseudo-random numbers inevitably are periodical. Therefore, $\gamma_{k+1} = \gamma_i$ for all $i \leq k$. An aperiodic length L is represented by the

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SOV/52-3-2-9/10

Pseudo-Random Numbers for the Machine "Strela"

numbers $\gamma_1, \gamma_2, \dots, \gamma_L$. Thus γ_{L+1} is equal to γ_i when $1 \leq i \leq L$. As an example a period of three consecutive values of γ_k can be examined: 1, 0.61328125, and 22.1394. Then L is found as equal to 87834. The length of period is the same in all three cases and equal to 53535. The testing of sequence for L can be carried out by means of the elementary probability method. If the probability of obtaining γ_k from a given set $\gamma_1, \gamma_2 \dots \gamma_N$ is equal to $1/N$, then the mathematical expectation of L can be derived from

$$E(L) = \sqrt{(1/2)\pi N}, \sigma(L) = \sqrt{(1/2)(4 - \pi)N}$$

For testing the groups of numbers, the value ν_{ij} and the number of co-ordinates $(\gamma_{2k-1}, \gamma_{2k})$ could be obtained from the formula R_{ij} and the test performed by the χ^2 method for various values of ν_{ij} . The result of such a

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30V/52-3-2-0/10

Pseudo-Random Numbers for the Machine "Strela"

test is shown in the table on p 209. It can be seen from the table that the test was satisfactory, i.e. the mean values of χ^2 , χ^2_2 , χ^2_6 correspond to the usual tests $(T_1)(T_2)(T_5)$ while the small differences such as χ^2_2 of the 5th group did not affect the result. There is 1 figure, 2 tables and 24 references, of which 6 are Soviet and 23 English.

SUBMITTED: January 20, 1958.

Card 4/4

17(6)

SOV/177-58-11-27/50

AUTHORS: Ibragimov, A.I., and Sobol', I.S., Lieutenant-Colonels of the Medical Corps

TITLE: A Set for Determining Vitamin C in Food

PERIODICAL: Voenno-meditsinskiy zhurnal, 1958, Nr 11, pp 77 - 78 (USSR)

ABSTRACT: A set has been designed for simplifying the practical work of the medical corps in determining vitamin C in the food in a sanitary-epidemiological squadron of the Moscow Military District (Figures 1, 2). With the aid of this set, 40-50 investigations for determining vitamin C in 24-hour rations and vegetables can be carried out without additional reactivities and materials. The set is designed for a 39 x 28 x 16 wood box. All laboratory vessels, reactivities and materials are placed in the set in special recesses and 19 elastic metal clamps guarantee the immobility of the devices and vessels. At the bottom of the set, there is a drawer with 11 recesses, in which

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SOV/177-58-11-27/50

A Set for Determining Vitamin C in Food

bottles with reactives and solutions and material are placed. Instead of 44 vessels enumerated in the instructions of the Main Military-medical Administration only 28 vessels, having a total weight of 2.5 kg (instead of 8.9 kg), are necessary. Since September 56, about 340 investigations of prepared food and vegetables were carried out. The set for determining vitamin C can be manufactured without special difficulties by units of the medical corps and by medical institutions. There is 1 photograph and 1 sketch.

Card 2/2

SOBOL', I. M., Candidate Phys-Math Sci (diss) -- "The use of analyses with Khaar functions for investigating integration lattices". Moscow, 1959. 5 pp (Acad Sci USSR, Math Inst im V. A. Steklov, Dept of Applied Math), 150 copies (KL, No 25, 1959, 127)

LUKOV, B.N., prof. (Kuybyshev); PETROV, V.I., dotsent (Moskva);
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 MAZO, I.L.; POKRYVALOVA, K.P.; PROSKURYAKOV, S.A., prof.;
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 MIKHLIN, Ye.G., prof.; TRET'YAKOVA, Z.V. (Moskva); MANUYLOV, Ye.N.,
 prof. (Moskva); DOROSHENKO, I.T., prof. (Kalinin); YERMOLAYEVA, V.G.,
 prof.

Speeches in the discussion. Trudy gos. nauch.-issl. inst. ukha,
 gorla i nosa no.11:79-87,129-146,179-186,233-248,311-333 '59.
 (MIRA 15:6)

1. Chlen-korrespondent AMN SSSR (for ADO). 2. Direktor Moskov-
 skogo gosudarstvennogo instituta ukha, gorla i nosa (for Trutnev).
 (OTORHINOLARYNGOLOGY—CONGRESSES)

I. . SOURCE

16(1), 16(2)
AUTHORS:
TITLE:

Leonidov, K.S., and Makova, E.S.
New Publications on Applied Analysis and Numerical Mathematics
(Novyye izdaniya po prikladnomu analizu i vychislitel'noy
matematike)

PERIODICAL: Uspekhi matematicheskikh nauk, 1959, VOL 14, NO. 1, PP. 1-10.
IT IS STATED THAT IN THE USSR THERE EXIST NO PERIODICAL ON
ABSTRACT: ... and similar domains. The papers of these

[illegible]

of standard-subprograms". There appeared the following collected volumes: "Numerical Mathematics and Computing Technique" (VMTV) since 1955, "Numerical Solution of Problems of Mathematical Physics" (NMP) since 1957, and "Computing Technique" (VT) since 1959. Until now two volumes of VMTV appeared with contributions from 1949, 1954, 1959, 1964, 1969, 1974, 1979, 1984, 1989, 1994, 1999, 2004, 2009, 2014, 2019, 2024, 2029, 2034, 2039, 2044, 2049, 2054, 2059, 2064, 2069, 2074, 2079, 2084, 2089, 2094, 2099, 2104, 2109, 2114, 2119, 2124, 2129, 2134, 2139, 2144, 2149, 2154, 2159, 2164, 2169, 2174, 2179, 2184, 2189, 2194, 2199, 2204, 2209, 2214, 2219, 2224, 2229, 2234, 2239, 2244, 2249, 2254, 2259, 2264, 2269, 2274, 2279, 2284, 2289, 2294, 2299, 2304, 2309, 2314, 2319, 2324, 2329, 2334, 2339, 2344, 2349, 2354, 2359, 2364, 2369, 2374, 2379, 2384, 2389, 2394, 2399, 2404, 2409, 2414, 2419, 2424, 2429, 2434, 2439, 2444, 2449, 2454, 2459, 2464, 2469, 2474, 2479, 2484, 2489, 2494, 2499, 2504, 2509, 2514, 2519, 2524, 2529, 2534, 2539, 2544, 2549, 2554, 2559, 2564, 2569, 2574, 2579, 2584, 2589, 2594, 2599, 2604, 2609, 2614, 2619, 2624, 2629, 2634, 2639, 2644, 2649, 2654, 2659, 2664, 2669, 2674, 2679, 2684, 2689, 2694, 2699, 2704, 2709, 2714, 2719, 2724, 2729, 2734, 2739, 2744, 2749, 2754, 2759, 2764, 2769, 2774, 2779, 2784, 2789, 2794, 2799, 2804, 2809, 2814, 2819, 2824, 2829, 2834, 2839, 2844, 2849, 2854, 2859, 2864, 2869, 2874, 2879, 2884, 2889, 2894, 2899, 2904, 2909, 2914, 2919, 2924, 2929, 2934, 2939, 2944, 2949, 2954, 2959, 2964, 2969, 2974, 2979, 2984, 2989, 2994, 2999, 3004, 3009, 3014, 3019, 3024, 3029, 3034, 3039, 3044, 3049, 3054, 3059, 3064, 3069, 3074, 3079, 3084, 3089, 3094, 3099, 3104, 3109, 3114, 3119, 3124, 3129, 3134, 3139, 3144, 3149, 3154, 3159, 3164, 3169, 3174, 3179, 3184, 3189, 3194, 3199, 3204, 3209, 3214, 3219, 3224, 3229, 3234, 3239, 3244, 3249, 3254, 3259, 3264, 3269, 3274, 3279, 3284, 3289, 3294, 3299, 3304, 3309, 3314, 3319, 3324, 3329, 3334, 3339, 3344, 3349, 3354, 3359, 3364, 3369, 3374, 3379, 3384, 3389, 3394, 3399, 3404, 3409, 3414, 3419, 3424, 3429, 3434, 3439, 3444, 3449, 3454, 3459, 3464, 3469, 3474, 3479, 3484, 3489, 3494, 3499, 3504, 3509, 3514, 3519, 3524, 3529, 3534, 3539, 3544, 3549, 3554, 3559, 3564, 3569, 3574, 3579, 3584, 3589, 3594, 3599, 3604, 3609, 3614, 3619, 3624, 3629, 3634, 3639, 3644, 3649, 3654, 3659, 3664, 3669, 3674, 3679, 3684, 3689, 3694, 3699, 3704, 3709, 3714, 3719, 3724, 3729, 3734, 3739, 3744, 3749, 3754, 3759, 3764, 3769, 3774, 3779, 3784, 3789, 3794, 3799, 3804, 3809, 3814, 3819, 3824, 3829, 3834, 3839, 3844, 3849, 3854, 3859, 3864, 3869, 3874, 3879, 3884, 3889, 3894, 3899, 3904, 3909, 3914, 3919, 3924, 3929, 3934, 3939, 3944, 3949, 3954, 3959, 3964, 3969, 3974, 3979, 3984, 3989, 3994, 3999, 4004, 4009, 4014, 4019, 4024, 4029, 4034, 4039, 4044, 4049, 4054, 4059, 4064, 4069, 4074, 4079, 4084, 4089, 4094, 4099, 4104, 4109, 4114, 4119, 4124, 4129, 4134, 4139, 4144, 4149, 4154, 4159, 4164, 4169, 4174, 4179, 4184, 4189, 4194, 4199, 4204, 4209, 4214, 4219, 4224, 4229, 4234, 4239, 4244, 4249, 4254, 4259, 4264, 4269, 4274, 4279, 4284, 4289, 4294, 4299, 4304, 4309, 4314, 4319, 4324, 4329, 4334, 4339, 4344, 4349, 4354, 4359, 4364, 4369, 4374, 4379, 4384, 4389, 4394, 4399, 4404, 4409, 4414, 4419, 4424, 4429, 4434, 4439, 4444, 4449, 4454, 4459, 4464, 4469, 4474, 4479, 4484, 4489, 4494, 4499, 4504, 4509, 4514, 4519, 4524, 4529, 4534, 4539, 4544, 4549, 4554, 4559, 4564, 4569, 4574, 4579, 4584, 4589, 4594, 4599, 4604, 4609, 4614, 4619, 4624, 4629, 4634, 4639, 4644, 4649, 4654, 4659, 4664, 4669, 4674, 4679, 4684, 4689, 4694, 4699, 4704, 4709, 4714, 4719, 4724, 4729, 4734, 4739, 4744, 4749, 4754, 4759, 4764, 4769, 4774, 4779, 4784, 4789, 4794, 4799, 4804, 4809, 4814, 4819, 4824, 4829, 4834, 4839, 4844, 4849, 4854, 4859, 4864, 4869, 4874, 4879, 4884, 4889, 4894, 4899, 4904, 4909, 4914, 4919, 4924, 4929, 4934, 4939, 4944, 4949, 4954, 4959, 4964, 4969, 4974, 4979, 4984, 4989, 4994, 4999, 5004, 5009, 5014, 5019, 5024, 5029, 5034, 5039, 5044, 5049, 5054, 5059, 5064, 5069, 5074, 5079, 5084, 5089, 5094, 5099, 5104, 5109, 5114, 5119, 5124, 5129, 5134, 5139, 5144, 5149, 5154, 5159, 5164, 5169, 5174, 5179, 5184, 5189, 5194, 5199, 5204, 5209, 5214, 5219, 5224, 5229, 5234, 5239, 5244, 5249, 5254, 5259, 5264, 5269, 5274, 5279, 5284, 5289

teorii matematicheskiy mashin") with contributions of Yu.Ya. Izrael, I.Ya. Akhmedov, Yu.A. Shrydler, E.A. Gluberg, I.M. Besilevskiy, V.S. Linskiy, A. Kosbarskiy, V. Maslov, B.I. Maslov, V.I. Maslov, V.I. Maslov.

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AUTHOR: Sobol', I.M.

TITLE: On the Solution of Peierl's Integral Equation by the Monte Carlo Method ^{1b}

PERIODICAL: Teoriya veroyatnostey i yeye primeneniye, 1960, Vol.5, No.3, pp. 361-366.

TEXT: If the first eigenvalue λ_1 of the integral equation

$$(1) \quad n(P) = \lambda \iiint_G \frac{\beta(P') \exp \left\{ -|P-P'| \int_0^1 \alpha[tP+(1-t)P'] dt \right\} n(P') d(P')}{4\pi|P-P'|^2}$$

equals 1: $\lambda_1 = 1$, then the reactor G with the parameters $\alpha(P)$ and $\beta(P)$ is critical.

V.S.Vladimirov (Ref.1) and the author (Ref.2) showed that the Monte Carlo method can be used for the solution of (1) and for the determination of λ_1 .

The following results of the present paper are new:

1. An infinite cylindric reactor G is considered. Then (1) reduces to an equation of the same type in the plane, where the kernel becomes

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Functions of Many Variables With Rapidly Converging Haar's Series

is denoted with S_p . Identifying the functions which distinguish only by a constant summand, then S_p is a complete linear normed space.

Theorem: The functions of the class S_p are continuous in all points of K with a probable exception of dyadic-rational points.

Let the function $f(p) = f(x_1, \dots, x_d)$ be defined on K . Let $\Delta_{\xi_s} f(p) = f(x_1, \dots, x_s + \xi_s, \dots, x_d) - f(x_1, \dots, x_d)$.

H_α , $0 < \alpha \leq 1$, is the set of functions which satisfy the following conditions in K :

$$(5) \quad |\Delta_{\xi_s} f(p)| \leq \frac{\alpha+1}{2} L |\xi_s|^\alpha; \quad |\Delta_{\xi_s} \Delta_{\xi_t} f(p)| \leq \left(\frac{\alpha+1}{2}\right)^2 L |\xi_s \xi_t|^\alpha, \quad s \neq t;$$

$$|\Delta_{\xi_1} \dots \Delta_{\xi_d} f(p)| \leq \left(\frac{\alpha+1}{2}\right)^d L |\xi_1 \dots \xi_d|^\alpha.$$

Theorem: If $\alpha p > 1$, then $H_\alpha \subset S_p$. Here

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S/020/60/132/05/19/069

AUTHOR: Sobol', I. M.

TITLE: Accurate Estimate of the Error of Multidimensional Quadrature
Formulae for S_p Functions

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 132, No. 5,
pp. 1041-1044

TEXT: Let P_1, \dots, P_N be points of the d-dimensional unit cube K with the coordinates x_{i1}, \dots, x_{id} ($i = 1, \dots, N$). Let the Haar functions $X_k(x)$ be denoted as in (Ref. 4). Let the class S_p of the functions of several variables be defined as in (Ref. 4). Let (m_1, \dots, m_d) , (k_1, \dots, k_d) etc. be denoted by m, k . Let

$$(1) \varphi_q(P_1, \dots, P_N) = \sup'_m \left\{ \sum_j \left| \sum_{i=1}^N s_j w [X_{k_1}(x_{i1}) - \dots - X_{k_d}(x_{id})] \right|^q \right\}^{1/q}$$

where sup' means that the case $m_1 = \dots = m_d = 0$ is to be excluded.
Let

$$(2) \delta_N(\varphi) = \int_K \varphi(p) dp - \frac{1}{N} \sum_{i=1}^N \varphi(P_i)$$

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Accurate Estimate of the Error of Multidimensional Quadrature Formulae
for S_p Functions

Theorem: For arbitrary P_1, \dots, P_N for K there holds for the functions
of the class S_p :

$$(5) \quad \|\delta_N\| = \frac{\varphi_q(P_1, \dots, P_N)}{N}, \quad \frac{1}{p} + \frac{1}{q} = 1$$

The author gives a geometric interpretation of the function φ_q ; from
it there follows e. g.

$$(6) \quad N^{1/q} \leq \varphi_q(P_1, \dots, P_N) \leq N$$

The author investigates the question of the best order of convergence
of the quadrature formulas for the class S_p and for the classes H_∞
embedded in S_p (Ref. 4). For $f \in H_\infty$ it holds:

$$(8) \quad |\delta_N(f)| \leq B \frac{\varphi_\infty(P_1, \dots, P_N) \ln^d N}{N^\alpha}$$

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Accurate Estimate of the Error of Multidimensional Quadrature
Formulae for S_p Functions


where $B \rightarrow L(e/2^{\alpha+1} d \ln 2)^d$ for $N \rightarrow \infty$. The estimation is not
accurate, however, $\ln^d N$ cannot be replaced by $\ln^{d-1} N$.

The author thanks A. N. Tikhonov for his interest in the paper.
S. M. Nikol'skiy is mentioned by the author.

There are 5 references: 4 Soviet and 1 Swiss.

PRESENTED: February 2, 1960, by M. V. Keldysh, Academician

SUBMITTED: January 26, 1960



Card 3/3

SOBOL', I.M. (Moskva)

Exact estimation of the error in multidimensional quadrature
formulas for class W_1 and H_1 functions. Zhur. vych. mat. i mat.
fiz. 1 no.2:208-216 Mr-Ap '61. (MIRA 14:8)
(Mathematics--Formulae) (Functional analysis)

10. $\frac{1}{2} \log 2$ (1 point)

Calculation of infinite-dimensional integrals. Zhur. vvol.
1961, No. 5:917-928 B-0 161. (MIR 14:10)
(Integrals)

25814
S/020/61/139/004/004/025
C111/C333

16.4500

AUTHOR:

Sobol', I. M.

TITLE:

Computation of n-dimensional integrals

PERIODICAL:

Akademiya nauk SSSR. Doklady, v. 139, no. 4, 1961, 821-823

TEXT: Consider the quadrature formula

$$\int_K f(P) dP \approx \frac{1}{N} \sum_{i=1}^N f(P_i) \quad (1)$$

where $P = (x_1, \dots, x_d)$, K -- unit cube ($0 \leq x_s \leq 1$, $s = 1, 2, \dots, d$); the nodes P_1, \dots, P_N lie in K .

In order to describe the "quality" of an arbitrary net P_1, \dots, P_N the author introduced the magnitude $\varphi_\infty(P_1, \dots, P_N)$ in his earlier papers (Ref. 1: DAN, 114, No. 4, 706 (1957); Ref. 3: DAN, 132, No. 4, 773 (1960); Ref. 4: DAN, 132, No. 5, 1041 (1960)). It holds the estimation

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Computation of n-dimensional . . .

$$\left| \int_K f(P) dP - \frac{1}{N} \sum_{i=1}^N f(P_i) \right| = O \left(\frac{\varphi_x(P_1, \dots, P_N) \ln^d N}{N^\alpha} \right)$$

here

$$1 \leq \varphi_x(P_1, \dots, P_N) \leq N \quad (2)$$

and $f(P) \in H_\alpha$ (Ref. 3), where H_α is the multidimensional analogue of the class Lip_α , $0 < \alpha \leq 1$.

Examples of good nets are given. Example 1: Let $N > 3$, a_1, \dots, a_d -- integers, $1 \leq a_s \leq N - 1$, $\{z\}$ the fractional part of z . If for the net

$$P_i = \left(\left\{ \frac{a_1}{N} i \right\}, \left\{ \frac{a_2}{N} i \right\}, \dots, \left\{ \frac{a_d}{N} i \right\} \right) \quad (3)$$

the optimal coefficients are chosen (see N. M. Korobov (Ref. 5: DAN, 124, No. 6, 1207 (1959))), then

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Computation of n-dimensional . . .

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$$\varphi_{\omega}(P_1, \dots, P_N) \leq B_1 \ln^d N,$$

where $B_1 \rightarrow 2d(2 + 8/\pi)^d$ for $N \rightarrow \infty$.

Let $r \geq 2$, $i = 1, 2, \dots$. If $1 = a_m r^m + \dots + a_1 r + a_0$, then let

$p_r(i) = a_0 r^{-1} + a_1 r^{-2} + \dots + a_m r^{-m+1}$, where the a_s can attain the values $0, 1, 2, \dots, r-1$.

Example 2: Let r_1, \dots, r_{d-1} be aliquant natural numbers, $N > \max r_s$.

For the net

$$P_1 = (i/N, p_{r_1}(i), p_{r_2}(i), \dots, p_{r_{d-1}}(i)) \quad (4)$$

with $i = 1, 2, \dots, N$ it is $\varphi_{\omega}(P_1, \dots, P_N) \leq B_2 \ln^{d-1} N$, where

$$B_2 = 4^d \prod_{s=1}^{d-1} (3r_s - 2) / \ln r_s.$$

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Computation of n-dimensional . . .

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C:11/C333

Example 3: For the net

$$P_i = (p_{r_1}(i), p_{r_2}(i), \dots, p_{r_d}(i)) \quad (5)$$

with $i = 1, 2, \dots$ it is $\varphi_{\infty}^0(P_1, \dots, P_N) \leq B_j \ln^d N$ for every $N > \max r_s$.

where

$$B_j = 4^d \prod_{s=1}^d (3r_s - 2) / \ln r_s.$$

There are 6 Soviet-bloc and 2 non-Soviet-bloc references.

PRESENTED: March 23, 1961, by M. V. Keldysh, Academician

SUBMITTED: March 14, 1961

Card 4/4

PHASE I BOOK EXPLOITATION SOV/6185

Buslenko, N. P., D. I. Golenko, I. M. Sobol', V. G. Sragovich,
and Yu. A. Shreyder

Metod statisticheskikh ispytaniy; metod Monte-Karlo (Method of
Statistical Testing; the Monte Carlo Method) Moscow, Fizmatgiz,
1962. 331 p. (Series: Spravochnaya matematicheskaya biblio-
teka) 22,000 copies printed.

Ed. (Title page): Yu. A. Shreyder; Eds. of Series: L. A.
Lyusternik and A. R. Yanpol'skiy; Ed.: V. D. Rozenknop; Tech.
Ed.: V. N. Kryuchkova.

PURPOSE: This book is intended for mathematicians, physicists,
and engineers engaged in the solution of problems in applied
mathematics. It can also be used by students and aspirants
studying the Monte Carlo method. Knowledge of the basic con-
cepts of the theory of probability is required for reading
this book. Some knowledge of random events and quantities
and their probability characteristics is desirable. Acquaint-
ance with the normal law of distribution, Lyapunov's theorem,

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Method of Statistical Testing; (Cont.)

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and the elements of mathematical statistics also is necessary.

COVERAGE: The Monte Carlo method of statistical testing by simulation of random processes on digital computers is described. Application of the method to neutron physics, communication theory, and queueing theory is reviewed. Methods for calculating multidimensional integrals and for obtaining and transforming random and pseudorandom numbers are considered in detail. There are 282 references: 69 Soviet (including 8 translations), 189 English, 8 German, 7 French, 3 Italian, 3 Japanese, 1 Swedish, 1 Dutch, and 1 Czech.

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| 1. Definition and elementary examples of the application of the Monte Carlo method | 11 |

Card 2/0 2

SOBOL', I.M. (Moskva)

Use of ω^2 distribution for estimating the error in calculating
integrals by a Monte Carlo method. Zhur.vych.mat.i mat.fiz. 2
no.4:717-723 J1-Ag '62. (MIRA 15:8)
(Integrals) (Probabilities)

I. 19493-63 EPF(c)/EWT(1)/EPF(n)-2/BDS-APFETC/ASD/IJP(C)/SSD Pr-
 S/0208/63/003/004/0702/0719
 ACCESSION NR: AP3004958

AUTHORS: Samarskiy, A. A.; Sobol', I. M. (Moscow)

TITLE: Examples of numerical computation of temperature waves

SOURCE: Zhurnal vy*chisl. matematiki i matematich. fiziki, v. 3, no. 4, 1963, 702-719

TOPIC TAGS: differential equation, heat equation, generalized solution, approximate solution

ABSTRACT: This paper is concerned with numerical solution of a quasilinear equation of heat conductivity

$$\frac{\partial u}{\partial t} = \sum_{\alpha=1}^p \frac{\partial}{\partial x_{\alpha}} \left(K_{\alpha}(u) \frac{\partial u}{\partial x_{\alpha}} \right) \quad (1)$$

for the cases $p = 1, 2, 3$. As usual it is always assumed that

$$K_{\alpha}(u) = \kappa_{\alpha} u^{\sigma_{\alpha}}, \quad (2)$$

where $\sigma_{\alpha} \geq 1, \kappa_{\alpha} > 0$. Although (1) arises in various areas of mathematical physics,

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ACCESSION NR: AP3004958

the authors, for definiteness, call the function $u = u(t, x_1, \dots, x_p)$ a temperature function. Ya. B. Zel'dovich and A. S. Kompaneys (K teorii rasprostraneniya tepla pri teploprovodnosti, zavislyashchey ot temperatury*. V "Sb. k semidesyatiletiyu akademika A. F. Ioffe". M., Izd-vo AN SSSR, 1950, 61-71.) and G. I. Barenblatt (O nekotorykh neustanovivshikhsya dvizheniyakh zhidkosti i gaza v poristoy srede. Prikl. matem. i mekhan., 1952, 16, No. 1, 67-78.) have shown that equation (1), in case $p = 1$, has a solution whose derivatives, at the points where $u(t, x)$ goes to zero, are discontinuous and the flow $K(u) \partial u / \partial x$ is continuous, i.e. there exists a temperature front $u = 0$ which is propagated with finite velocity. In this case the equation has no classical solution. The existence of a generalized solution of the Cauchy problem and boundary value problems are proven by O. A. Oleynik, A. S. Kalashnikov and Chou Yu-lin (Uraveniya tipa nestatsionarnoy fil'tratsii. Izv. AN SSSR, 1958, 22, No. 5, 667-704.) and others proved convergence of an explicit difference scheme for an equation of the form

$$\frac{\partial u}{\partial t} = \frac{\partial^2 F(u)}{\partial x^2} \quad (3)$$

in the class of generalized solutions (these results can probably be extended to the case of implicit schemes). M. A. Tairov (Resheniye odnoy zadachi nestatsionarnoy fil'tratsii metodom integral'nykh sootnosheniy. Zh. vychisl. matem. i matem. fiz.,

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1962, 2, No. 5, 938-942) computed the generalized solution of an equation of the form (3) by Dorodnitsy'n's method of integral relations. For computation of such generalized solutions (which they call temperature waves or simply solutions) the authors use homogeneous difference schemes of continuous computation not specifying clear separation of points of weak discontinuity. The theory of such schemes has been worked out by various authors. However, all the proofs of convergence assume that $K_{\Delta}(u) \geq c > 0$ and despite the great generality of these theorems, they are not applicable to the case where $K_{\Delta}(u)$ goes to zero (even allowing discontinuous functions $K_{\Delta} = K_{\Delta}(t, x, u)$). The aim of this article is to show that these schemes are also suitable for computation of temperature waves. Such schemes make it possible to carry out the computation by large steps in time, to give the velocity of propagation of the front well, and, for a sufficiently fine grid, also the profile of the front. In the case of space variables ($p > 1$) the authors use the locally one-dimensional method of variable directions set forth by A. A. Samarskiy (Ob odnom ekonomichnom raznostnom metode resheniya mnogomernogo parabolicheskogo uravneniya v proizvol'noy oblasti. Zh. vychisl. matem. i matem. i fiz., 1962, 2, No. 5, 787-811) and (Local'no-odnomernyye skhemy na neravnomernoy setke dlya mnogomernykh parabolicheskikh uravneniy. Zh. vychisl. matem. i matem. fiz., 1963, 3, No. 3, 431-466). The authors give a brief characterization of the

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method of the last two cited papers which is applicable to equation (1). A step in time $t_j \leq t \leq t_{j+1}$ is divided into p layers of identical thickness ("fractional steps")

$$t^{j+(a-1)/p} \leq t \leq t^{j+a/p}, \quad a = 1, 2, \dots, p. \quad (4)$$

In the layer numbered a one solves the one-dimensional equation

$$\frac{1}{p} \frac{\partial u}{\partial t} = \frac{\partial}{\partial x_a} \left(K_a(u) \frac{\partial u}{\partial x_a} \right). \quad (5)$$

Here, all other coordinates x_β , distinct from x_a , play the role of parameters. At this stage, for boundary conditions the authors use values of the boundary functions at points of intersection of straight lines parallel to the ox_a axis from the boundaries of the region of integration, and for initial values they take values obtained from computation of the preceding layer. Actually, for solution of all the equations (5) they use one and the same one-dimensional program in which (5) is replaced by an implicit homogeneous difference scheme (in section 2, § 2). The authors claim that in their opinion there is no more suitable method at present for

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the solution of multidimensional quasilinear parabolic equations. This method is applicable to arbitrary regions (not only to parallelepipeds) and keeps its order of accuracy on inhomogeneous grids. It is suitable for quasilinear parabolic equations of general form even in the presence of coefficients of discontinuities (type I). In such a wide area of usefulness, the method of variable directions has a whole series of merits; simplicity of the program, lowering (in contrast to the majority of other schemes) of the required size of operative memory, stability of computation with very coarse steps in time. It makes it possible, in particular, to solve rapidly complex problems where great accuracy is not required. Computations by any difference scheme give, instead of the exact wave profile, some difference profile (the finer the grid, the greater the accuracy). For studying the construction of this profile with a very coarse grid and estimating the effective width of the front, the authors constructed, in §5, for the case $p = 1$, a difference running wave — an analog to the well known equation of the form $u = f(ct - x)$, called a running wave (the constant c is the velocity of the wave). For difference schemes of continuous computation of gas dynamics with viscosity the difference running wave was constructed by A. A. Samarskiy and V. Ya. Arsenin (O chislennom reshenii uravneniy gazodinamiki s razlichnyimi tipami vyazkosti. Zh. vychisl. matem. i matem. fiz., 1961, 1, No. 2, 357-360). It is necessary to stress that the authors never tended to choose the most favorable conditions for computation of a given problem. On the

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contrary, in some cases they knowingly chose bad conditions in order to make the work more remarkable. The grids in the area of some examples are coarse, in others, rather fine. The step in time is always coarse. Orig. art. has: 24 formulas, 8 tables, and 10 figures.

ASSOCIATION: none

SUBMITTED: 06Apr63

SUB CODE: MM

DATE ACQ: 30Aug63

NO REF SOV: 015

ENCL: 00

OTHER: 000

Card 6/6

SOBOL', I.M. (Moscow)

Periods of pseudo-random sequences. Teor. veroyat. i ee prim.
(MIRA 1787)
9 no.20367-373 1964

SOBOL', I.M., prof.

Results of the use of local potentiated anesthesia in
otorhinolaryngological operations. Uch. zap. Stavr. gos.
med. inst 12:286-287 '63. (MIRA 17:9)

1. Kafedra bolezney ukha, gorla i nosa (zav. prof. I.M. Sobol')
Stavropol'skogo gosudarstvennogo meditsinskogo instituta.

SOBOL, Jozef, inz.

Activities of the Association of Engineers and Technicians in
Agriculture and cooperation with the graduate agricultural engineers
in the German Democratic Republic. Przegl techn 84 no.16:7 21 Ap '63.

SOBOL', L.I.

MECHNIKOV, I.I.; KROTKOV, F.G., glavnyy redaktor; VASETSKIY, G.S., redaktor;
BELKIN, R.I., redaktor; ANICHKOV, N.N., redaktor; ZHDANOV, V.M., re-
daktor; BEKLEMISHEV, V.N., redaktor; KRAYEVSSKIY, N.A., redaktor;
BEKLEMISHEV, V.N., redaktor; KRAYEVSKIY, N.A., redaktor; PAVLOVSKIY,
Ye.N., redaktor; VYGODCHIKOV, G.V., redaktor; SOBOL', L.I., redaktor;
ROTERMEL', R.P., tekhnicheskiiy redaktor.

[Collected works published by the Academy] Akademicheskoe sobranie
sochinenii. Redaktsionnaya kollegiya: F.G.Krotkov i dr. Moskva, Gos.
izd-vo med. lit-ry. Vol. 13. 1954. 242 p. (MIRA 7:11)
(Biology)

SOBOL', L.V., inzh.

Device for testing ITM-2 microphone capsules. Vest. svyazi 22
no.1318 Ja '62. (MIRA 14:12)

1. Tsentral'noye konstruktorskoye byuro Ministerstva svyazi
SSSR.

(Microphone...Testing)

SOBOL', Nikolay Aleksandrovich [Sobol', M.O.]; BARABASHOV, Nikolay Pavlovich [Barabashov, M.P.], akademik; KARDASH, G.I. [Kardash, H.I.], red.; LIMANOVA, M.I. [Lymanova, M.I.], tekhn.red.

[Soviet science in the service of our people] Radians'ka nauka na sluzhbi u narodu. Kharkiv, Kharkivs'ke knyzhkove vyd-vo, 1959. 35 p. (MIRA 13:4)

1. Golova Kharkivs'kogo radnargospu (for Sobol'). 2. Ukrainskaya Akademiya nauk (for Barabashov). (Ukraine--Research, Industrial) (Artificial satellites)

L 34414-66

ACC NR: AT6022229

SOURCE CODE: UR/0000/66/000/000/0007/0013

AUTHOR: Kukush, V. D.; Oychinnikov, I. K.; Taar, Ya. P.; Zhilkov,
V. S.; Pasechnik, V. P.; Sobol', N. K.; Volkov, V. M.

ORG: none

TITLE: Device for measuring deviations in the power level

SOURCE: Vsesoyuznaya nauchnaya sessiya, posvyashchennaya Dnyu radio,
22d, 1966. Sektsiya radioizmereniy. Doklady. Moscow, 1966, 7-13

TOPIC TAGS: power meter, electric measuring measurement, generator

ABSTRACT: A device for measuring the output power of uhf generators is described. The device operates on the principle of a balanced static calorimeter used for precise power measurements in the centimeter and millimeter ranges. The system incorporates a balanced static calorimeter and a measuring block. The balanced calorimeter consists of two identical coaxial loads, i.e., an hf load and a compensated load. D-c heaters are incorporated directly in the loads. The measuring block consists of three basic sections: a d-c amplifier, a measuring circuit, and stabilized power supply sources. The following data were obtained in experiments with the device which characterize its efficiency: voltage standing wave ratio of the terminal section is practically

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L 34853-66

ACC NR: AP6021790

transformers have three terminals (two end terminals and a center tap each). The end terminals of opposite transformer sections are connected to each other through rectifier diodes. The load and a ballast resistor are tied to transformer secondary center taps connected in pairs as indicated. This arrangement increases the efficiency of the unit with respect to the reference voltage source and assures an abrupt limiting of the output voltage when the linear range of the characteristic is exceeded (see Fig. 1). Orig. art. has: 1 figure. [BD]

SUB CODE: 09/ SUBM DATE: 12Mar65/ ATD PRESS: 5032

Card 3/3 FV

SOBCL, N. L.

4507. Apparatura dlya kompleksnogo kontrolya vragochnogo protsessa. M., 1954.
11 S. 25 SM. (AKAD. nauk SSR. in-ttekn. - ekon. informatsii. Periodich informatsiya
tema No. 6). 700 Ekz. B. TS. - NA OBL. AVF neukazan. - (55-518) 621.745.342

SO: Knizhaya Letopis, Vol. 1, 1955

SOBOL, N.L.

Over-all control and regulation of basic processes of cupola
furnace melting. Lit.proizv. no.9:16-19 S '57. (MIRA 10:10)
(Cupola furnaces)
(Automatic control)

SOBOL', N.L.

Mechanization of the melting shop at the "Stankolit" Plant.
Lit. proizv. no.9:17-18 S '60. (MIRA 13:9)
(Machine-Tool industry) (Foundries)

SOBOL', N.L.

Highly efficient cupola fans. Lit. proizv. no.1:14-17 Ja '61.
(MIRA 14:1)

(Cupola furnaces)

(Fans, Mechanical)

S/128/61/000/001/004/009
A054/A133

AUTHORS: Kletskin, G. I.; Sobol', N. L.; D'yakonov, V. Ye.;
Rabinovich, V. D., and Van Zhu-Yao.

TITLE: Study of processes in cupola furnaces in which part of the coke
is replaced by natural gas

PERIODICAL: Liteynoye proizvodstvo, no. 1, 1961, 19-25

TEXT: Although several Soviet plants use natural gas for firing furnaces, there is still a number of problems connected with the replacement of coke by gas. In cooperation with the Mosgazoprojekt Institute the Stan-kolit Plant put a coke-gas fired 10 - 12 t/h capacity cupola furnace into service last year, which is equipped for tests. As to the design of gas-fired furnaces, the general opinion is that when fired only by natural gas, the cupola design must be changed radically and should be given a shape resembling a shaft or air furnace. When both coke and gas are applied, however, its design has to undergo only slight modifications and, if necessary, the furnace can be fired by coke only. Special features of the furnace converted for coke and gas firing (Fig. 1) are the two collectors which feed

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Study of processes in cupola furnaces...

air to the tuyeres and the burners, respectively. The tuyères are moreover arranged only in one row in connection with the considerably reduced amounts of coke and air used. In order to establish the optimum height of the burner assembly, twelve burners were mounted in the test-cupola in three rows, the first at a height of 770, the second at 1,070 and the third at 1,370 mm from the axis of tuyères. At the simultaneous combustion of gas and coke the regulation and distribution of the blast between tuyères and burners is very important. With the collectors (4, 5 in Fig. 1) which operate in combination with independent fans, the required constant gas-coke ratio in the cupola can be set and maintained. Complete burning of the gas outside the shaft is obtained by a special tunnel-antechamber for the discharge of the gas-air mixture from the burners. The most suitable burner for cupolas fired with mixed fuels is the double-circuit type, in which the gas and the air can be pre-mixed and the outlet cross section is such that the speed of the outflowing air-gas mixture is more than 40 - 50 m/sec. During smelting in the cupola furnace the parameters of gas and air consumption for tuyères and burners change constantly. The control panel (Fig. 4) has push buttons controlling the slidevalve mechanisms (16, Fig. 4), the push button for stopping the cupola operation in case of danger (17, Fig. 4), a button for au-

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A054/A133

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dible and one for light signals (18, 20, Fig. 4), a safety-release button (19, Fig. 4). In order to maintain a constant gas pressure before the burners and to ensure the combustion of gas at a given ratio to air, two jet-regulators from the Khar'kovskiy zavod Teploavtomat (Khar'kov Teploavtomat Plant) are mounted, one controlling the gas pressure (8, Fig. 4), the other the gas-air ratio (9, Fig. 4). The controlling pulse is given to the pressure regulator when the gas pressure before the burners attains 0.27 atmospheres. The change in pressure before the burners is compensated by a valve (operated by a CK-80-15 = SK-80-15 servo-motor), moving before the burners in the required direction to equalize the gas pressure. The gas-air ratio regulator receives pulses of pressure drops from a diaphragm which controls the gas and air consumption (differential type AПЗМ (DPEM) pressure gauge). Air consumption of the tuyères and burners is controlled by an Э-610 (E-610), gas consumption by an Э-612 (E-612) device. In order to prevent gas-explosions, a ПК-100 (PK-100) safety valve, designed by the Mosgazproyekt, is mounted in the gas conduit; it is equipped with an electromagnet whose head is connected to the air-collector of the burners through a pulse pipe. When the air-pressure drops below a certain value, the gas supply is switched off automatically. When the gas pressure drops below 0.15 atm, the СПАС-1.5

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(SPDS-1.5) gas-pressure indicator (12, Fig. 4), starts operating and the gas-supply is stopped. The operation of all these devices is signaled by a flashlight (20) and a howler (13). The air-collectors are provided with valves to prevent their destruction in case of explosion. The smelting process, the quality of metal smelted in a mixed-fuel cupola and the composition of the combustion products were studied with various rows of burners (I, II, III) and also with different combinations, respectively: at the same time I-II, II-III, I-III and all three. The other conditions of the process (composition of the charge, for C⁴ 24-44 (SCh 24-44) iron, firing conditions and temperature, etc.) were identical in all tests. It was found that by charging 100 kg coke and 30 m³ gas into the furnace for 1 ton iron, 875,000 kcal heat was introduced, as against 992,000 kcal of heat used for the same amount of iron in furnaces fired by coke only. This can be explained by the fact that less heat is spent on slag formation due to the decrease in the amount of flux applied and to the improvement of heat transfer to the charge in the cupola furnaces, partly fired by gas. An analysis of the gas composition in coke-fired and coke-gas fired cupolas showed that the CO₂/CO ratio is higher in the latter type of furnaces. It was found that by mounting the burners higher in the furnace shaft the CO₂ content of furnace

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gases increases while the CO content decreases. The hydrogen content also increases in furnaces with mixed fuels (it is 2 - 2.5 %, three times more than when firing with coke alone). The higher the burners are placed, the higher the hydrogen content. Figure 7 presents the temperature conditions of mixed-fuel cupolas and shows that they are 150 - 300°C higher than those in coke fired furnaces. At a level of 3 m from the tuyère the temperature of separating gases attains 950°C in the coke-gas furnace, (when row I of burners is operating), while the corresponding temperature for coke-fired furnaces is 650 - 700°C. Thus, the smelting of the metal charge begins at higher levels in the coke-gas fired furnace. As to the behavior of carbon, silicon and magnesium, no change is found in iron smelted in mixed-fuel cupolas, while the sulphur content decreases by 0.01 - 0.02 %. When the burners of the upper row are used, iron shows an increased tendency to form cementite and shrinkage cavities, while its fluidity seems to decrease. Moreover, iron produced in mixed-fuel furnaces has a higher hardness (by 10 - 15 Brinell grades) while the mechanical properties do not change. The lining of mixed-fuel furnaces requires more frequent repairs since it burns higher up. The coating consists of 35 % sand, 25 % refractory clay and 40 % waste of fireclay bricks. Especially the coating of gas-burner tunnels has to be

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in perfect condition, because the regularity of the geometrical form of the tunnel greatly affects the intensity of gas combustion. Coating with fire-clay blocks was too expensive, a refractory mass is therefore used. The operation conditions of the mixed-fuel cupola are given in Table 6. The coke bed is 1,400 mm high. When the normal operation conditions are attained, further operation is controlled automatically. The experience of 14 months of operation has shown that the mixed-fuel cupola works satisfactorily with 10 % coke for 300 nm³/hour gas at an air consumption of 5,000 nm³/hour, producing 10 tons of iron per hour at a temperature of 1,430°C in the chute. The output of the mixed-fuel cupola is increased by 20 - 25 % as compared with coke-fired cupolas. There are 6 tables and 13 figures. ✓

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L 42419-65

ACCESSION NR: AP5008775

EWG(j)/EWT(m)/EPF(c)/EPR/EWP(t)/EWP(b)

Pr-4/ps-4 IJP(c) JD
S/0240/65/000/003/0042/0048

AUTHOR: Sobol', N. V.; Breger, A. Kh., Petushkov, A. A.

TITLE: Materials used for calculating air exchange in rooms with powerful gamma-radiation units

SOURCE: Gigiyena i sanitariya, no. 3, 1965, 42-48

TOPIC TAGS: gamma radiation, air exchange, radiation environment

ABSTRACT: The formation of ¹⁷ozone and ¹⁷nitrogen oxides is the basic permanent factor which must be considered when calculating air exchange during irradiation. The authors give experimental data collected during the calculation of air exchange in rooms used for powerful Co⁶⁰ units (K-6000, GURKh-40000, TsNIIKOP). The air was analyzed for ozone content as well as nitrogen oxides and nitrogen dioxide. After irradiation under conditions which permitted no air exchange, the amount of nitrogen dioxide in the total oxides present in the irradiated air ranged from 36 to 83%. The deviation from the average nitrogen dioxide concentration was as much as 50% in individual cases, but for the total content of nitrogen oxides it did not exceed 5%. Hence, the authors determined only the total content of nitrogen oxides.

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ACCESSION NR: AP5008775

Equations derived from theoretical calculations and nomograms were used to determine the air flow and air exchange rate in irradiation chambers and these were related to the size of the room and the activity of the irradiation unit. The validity of the equations was confirmed experimentally. Orig. art. has: 6 figures, 2 tables.

ASSOCIATION: Institut gigiyeny truda i profzabolevaniy AMN SSSR (Institute of Industrial Hygiene and Occupational Diseases, AMN SSSR); Fiziko-khimicheskiy institut im. L. Ya. Karpova, Moscow (Institute of Physical Chemistry)

SUBMITTED: 15Apr64

ENCL: 00

SUB CODE: NP

NO REF SOV: 009

OTHER: 000

Card 2/2

40054
S/089/62/013/002/011/011
3102/3104

074400
AUTHORS:

Klyugin, S. A. (Deceased), Shtal', M. Z., Sobol', N. V.

TITLE:

Measurements of the emanation content in ventilated rooms by the filter method

PERIODICAL: Atomnaya energiya, v. 13, no. 2, 1962, 189-191

TEXT: The filter method (Harley, Nucleonics, 11, no. 7, 12, 1953; Schuman, Arch. Meteorol., Geophys. und Bioklimatol., 9, no. 2, 204, 1956) was applied to determine the emanation concentration $Q_{em} = N_1 \lambda_1 = A(T)/vF(T, t_0, k)$.

Here, $A(T)$ denotes the time dependence of the α -activity of the filter, t_0 the filtering time, v the rate of air transmission through the filter and T the moment of α -activity measurement. $F(T, t_0, k)$ is a function of

$\lambda_{1,2,3,4}$, the Rn , RaA , RaB , RaC decay constants. The radon concentration determined by the filter method was always higher than that determined electrometrically. If the air contains mixed emanations of commensurable

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S/C89/62/013/002/011/011

B102/B104

Measurements of the emanation ...

amounts two cylindrical filters have to be used successively (Atomnaya energiya, 10, no. 1, 64, 1961). For $t_0 = 30$ min $A(T)$ has been determined for different k (0, 1, 5, 10, 20, 40, 60, 100) for Rn- as well as Tn-contaminated air. Also $A(T)/N_1 \lambda_1 = v \tau_0$ as dependent on $\tau_0 \sim 1/v$ was measured for different T and Rn- and Tn-contaminated air. τ_0 is the time of passage of the air through the filter tube. The curves show that the activity of the Tn deposits increases with increasing aspiration rate whereas that of the Rn deposits was almost independent of the rate. The filter method has proved to be the simplest for determining the emanation concentration directly and, at the same time, the most sensitive (Tn concentration determination down to 10^{-12} curies/liter). There are 2 figures and 1 table.

SUBMITTED: June 17, 1961

Card 2/2

SOBOL', N.V.; PETUSHKOV, A.A.; BREGER, A.Kh.

Foundations for airing standards in working chambers of high-power
gamma irradiation plants. Atom energ. 16 no.3:262-264 Mr '64.
(MIRA 17:3)

SOBOL', N.V.; PETUSHKOV, A.A.; BREGER, A.Kh.

Calculation of fresh air requirements in rooms housing high-
power gamma-ray sources. Atom. energ. 19 no.2:201 Ag '65.
(MIRA 18:9)

L 14678-66 EWT(m)/EPF(n)-2 DIAAP

ACC NR: AP6008262

SOURCE CODE: UR/0089/65/019/002/0201/0201

AUTHOR: Sobol', N. V.; Petushkov, A. A.; Breger, A. Kh.

53
B

ORG: none

TITLE: Air-exchange calculation in rooms for high-power gamma units

19,55

SOURCE: Atomnaya energiya, v. 19, no. 2, 1965, 201

TOPIC TAGS: radiation chemistry, nitrogen oxide, ozone, explosive gas, gamma radiation, ventilation engineering, radiation shielding

ABSTRACT: Correlations were made of various data on radiochemical yields and permissible doses of nitrogen oxides and ozone formation and toxicity. The possibility of explosive gas accumulations in case of mixed shielding and water shielding of the source was analyzed, and it is suggested that regular ventilation of the room excludes the danger of explosive gas accumulations. Orig. art. has: 3 formulas. NA

SUB CODE: 18, 07 / SUBM DATE: 24Nov64 / ORIG REF: 007

Card 1/1

UDC: 697.92: 539.122

SOBOL, Ryszard, inz.

Tables for determining effective attenuation of attenuation equalizers
with elements of loss. Prace Inst teletechn 3 no.2:172-174 '59.

SOBOL, Ryszard, 182.

Electrolytic tank for the design of electric filters. Prace Inst
teletechn 4 no.1:84-86 '60.